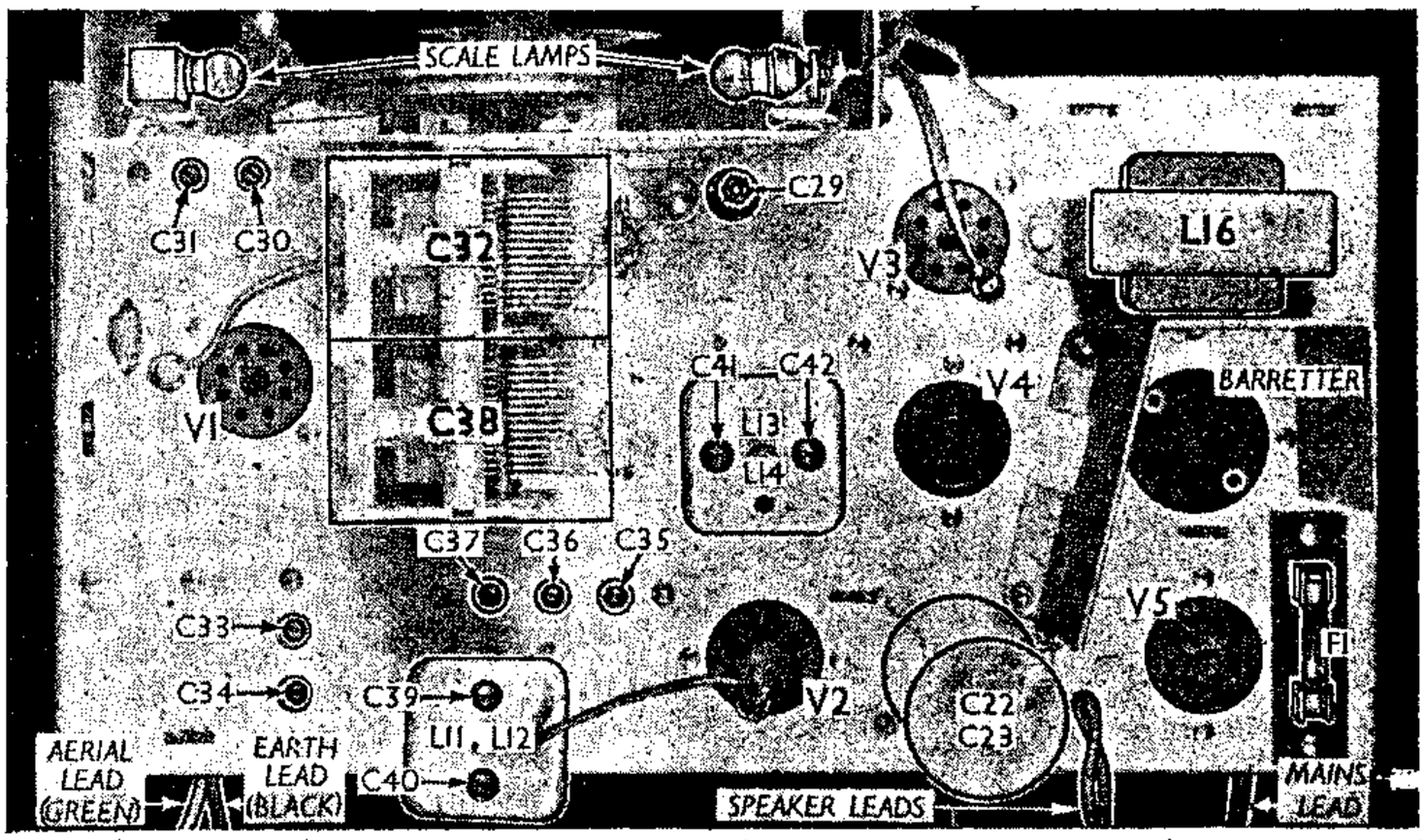
Supplement to The Wireless & Electrical Trader, February 27, 1943

FERGUSON 101U
AND EXPORT MODEL 101UX

THE Ferguson 101U is a 4-valve (plus rectifier) 3-band superhet, designed to operate from AC or DC mains of 200-250 V, 40-100 C/S in the case of AC. The short-wave range is 13.5-50 m.

The differences in the model 101UX (export model) are explained under "Export Model Modifications" overleaf. The wavebands in the export model are: SW1, 13.5-50 m; SW2, 50-166.5 m; and MW band (marked BB for broadcast band). A special export model is available with a tapping for low voltage mains. All models use the same cabinet. This *Service Sheet* was prepared from a 101U.

Release date and original price, both models: January, 1941; £11 0*s.* 6*d. Special low mains voltage models* 15*s. extra* (*X models only*).



Plan view of the chassis. All the trimmer and tracker adjustments are indicated, and can be reached without removing the chassis from the cabinet.

COMPONENTS AND VALUES

	RESISTANCES	Values (ohms)
R1	V1 heptode CG decoupling	550,000
R2	V1 fixed GB resistance	330
R3	V1 osc. CG resistance	50,000
R4	Osc. SW reaction damping	50
R5	Osc. LW reaction damping	10,000
R6	V1 osc. anode HT feed	27,000
R7	V2 CG decoupling	500,000
R8	V1, V2, SG's HT feed	60,000
R9	V2 fixed GB resistance	300
R10	IF stopper	82,000
R11	V3 signal diode load	500,000
R12	Manual volume control	2,000,000
R13	V3 fixed GB; AVC delay	1,000
R14	V3 triode anode load	50,000
R15, R16	V3 AVC diode load resistances	560,000, 560,000
R17	V4 CG resistance	560,000
R18	V4 GB resistance	150
R19	V4 anode stopper	100
R20	Variable tone control	100,000
R21	V5 surge limiter	100
R22	Scale lamp shunt	200

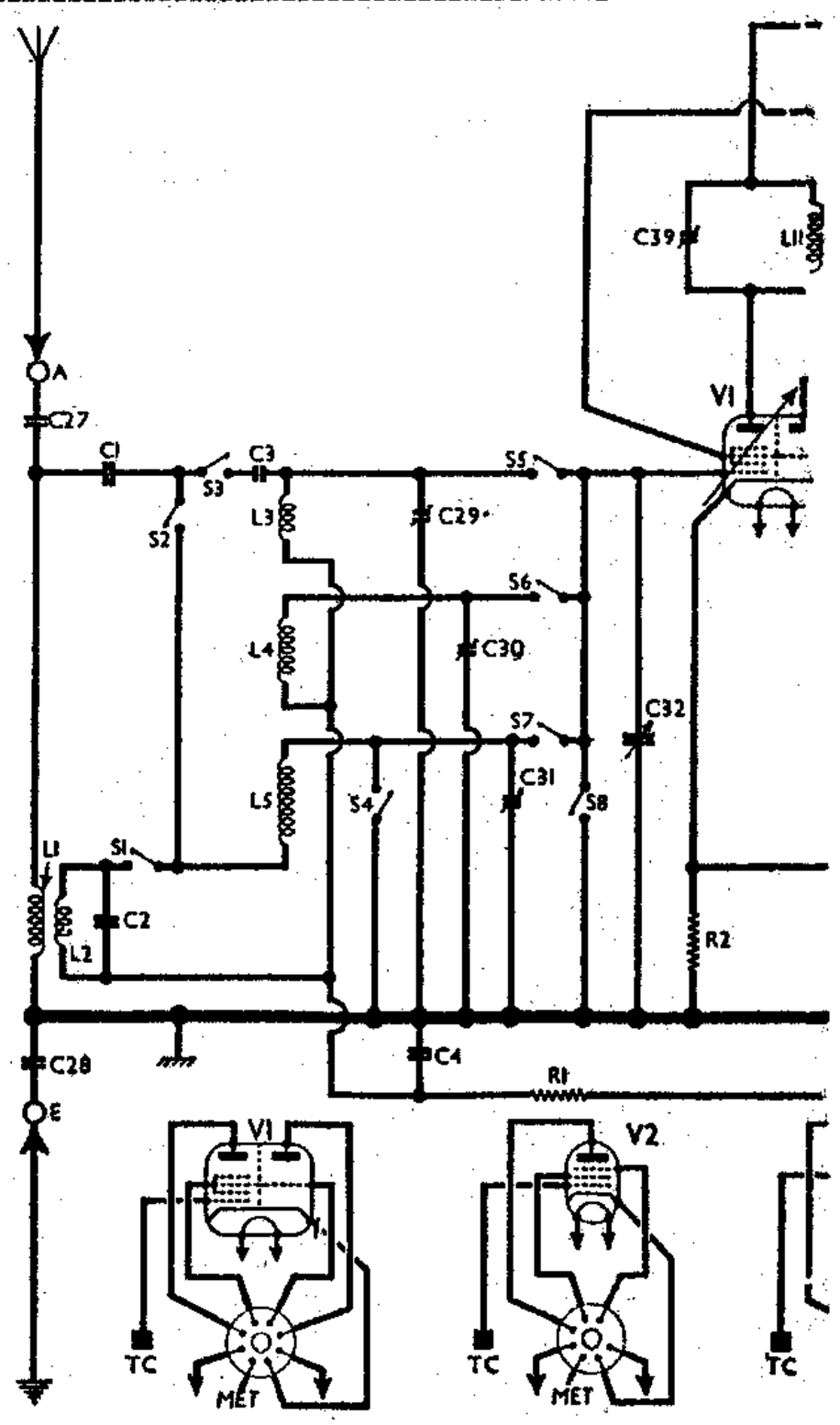
	OTHER COMPONENTS	Approx. Values (ohms)
L1	Aerial circuit choke	330·0
L2	Aerial LW coupling	20·0
L3	Aerial SW tuning coil	Very low
L4	Aerial MW tuning coil	3·0
L5	Aerial LW tuning coil	26·0
L6	Oscillator SW reaction	0·1
L7	Oscillator MW reaction	1·0
L8	Osc. circ. SW tuning coil	Very low
L9	Osc. circ. MW tuning coil	2·0
L10	Osc. circ. LW tuning coil	5·25
L11	1st IF trans. Prl.	8·5
L12	1st IF trans. Sec.	8·5
L13	2nd IF trans. Pri.	8·5
L14	2nd IF trans. Sec.	8·5
L15	Speaker speech coil	2·0
L16	HT smoothing choke	300·0
L17, L18	Mains filter chokes	4·5, 4·5
T1	Speaker input trans. Pri.	400·0
	Speaker input trans. Sec.	0·3
F1	Mains fuse, 5A	—
S1-S15	Waveband switches	—
S16	Gram PU switch	—
S17	Mains switch, ganged R12	—

	CONDENSERS	Values (μF)
C1	Aerial MW. coupling	0·0005
C2	Part LW coupling	0·002
C3	Aerial SW coupling	0·00001
C4	V1 heptode CG decoupling	0·1
C5	V1 cathode by-pass	0·1
C6	V1 osc. CG condenser	0·0001
C7	Osc. circuit SW tracker	0·005
C8	V1 osc. anode coupling	0·0001
C9	V2 CG decoupling	0·1
C10	V1, V2 SG's decoupling	0·1
C11	V2 cathode by-pass	0·1
C12	IF by-pass condensers	0·00025
C13	IF by-pass condensers	0·00025
C14	HT circuit by-pass	0·1
C15	Coupling to V3 AVC diode	0·0001
C16	AF coupling to V3 triode	0·02
C17	IF by-pass condenser	0·0001
C18*	V3 cathode by-pass	25·0
C19	V3 triode to V4 coupling	0·02
C20	Fixed tone corrector	0·005
C21	Part variable tone control	0·05
C22*, C23*	HT smoothing condensers	16·0, 16·0
C24	Mains RF by-pass	0·01
C25*	V4 cathode by-pass	25·0
C26	PU mains isolator	0·1
C27	Aerial mains isolator	0·002
C28	Earth mains isolator	0·1
C29‡	Aerial circ. SW trimmer	0·00003
C30‡	Aerial circ. MW trimmer	0·00003
C31‡	Aerial circ. LW trimmer	0·00011
C32†	Aerial circuit tuning	—
C33‡	Osc. circuit MW tracker	0·0006
C34‡	Osc. circuit LW tracker	0·00025
C35‡	Osc. circuit SW trimmer	0·00003
C36‡	Osc. circuit MW trimmer	0·00003
C37‡	Osc. circuit LW trimmer	0·0002
C38†	Oscillator circuit tuning	—
C39‡	1st IF trans. pri. tuning	—
C40‡	1st IF trans. sec. tuning	—
C41‡	2nd IF trans. pri. tuning	—
C42‡	2nd IF trans. sec. tuning	—

* Electrolytic. † Variable. ‡ Pre-set.

CIRCUIT DESCRIPTION

The aerial coupling arrangements in the Ferguson 101U do not follow normal practice. The primary of a transformer **L1, L2, C2** is permanently connected across the aerial circuit, and on LW, low impedance secondary winding **L2** is connected



Circuit diagram of the Ferguson 101U AC/DC

via switch **S1** in the low potential end of the LW aerial tuning circuit **L5, C32,** and thus injects the signal into the circuit. The actual aerial and earth leads are isolated by condensers **C27** and **C28.**

On MW, **S1** opens, while **S2** and **S4** close, so that the "top" of **L5** is connected to chassis, and the "bottom" of it is connected via **S2, C1** to the aerial, and the coil becomes "inverted." Since it is wound on the same former as **L4,** it is magnetically coupled to it, and thus transfers the signal to the MW tuning circuit, **L4, C32.**

On SW, **S1** and **S2** are open, and **S3** is closed, providing a normal coupling via the series condenser **C3** to the SW tuning circuit **L3, C32.** On the MW and SW bands, **L1** remains in circuit, but it behaves as a high impedance choke shunt.

First valve **(V1, Mullard metallised CCH35)** is a triode-heptode operating as frequency changer with internal coupling. Triode oscillator anode tuning coils **L8** (SW), **L9** (MW) and **L10** (LW) are tuned by **C38.** Parallel trimming by **C35** (SW), **C36** (MW) and **C37** (LW); series tracking by **C7** (SW), **C33** (MW) and **C34** (LW).

Reaction coupling is established by including the trackers in the grid and anode return paths to chassis on all bands, so that they form a common coupling impedance. This coupling is augmented on the SW band by the reaction coil **L6,** and similarly on the MW band by **L7.**

Second valve **(V2, Mullard metallised EF39)** is a variable-mu RF pentode operating as intermediate frequency amplifier with tuned-primary, tuned-secondary transformer couplings **C39, L11, L12, C40** and **C41, L13, L14, C42.**

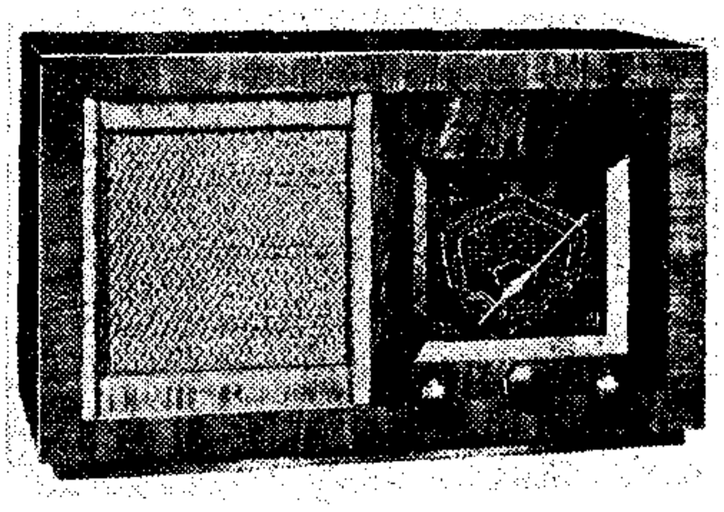
Intermediate frequency 470 KC/S.

Diode second detector is part of double diode triode valve **(V3, Mullard metallised EBC33).** Audio frequency component in rectified output is developed across load resistance **R11** and passed via IF filter circuit comprising condensers **C12, C13** and resistance **R10,** AF coupling condenser **C16,** manual volume control **R12** and further IF by-pass condenser **C17** to CG of triode section, which operates as AF amplifier.

Provision for connection of gramophone pick-up by sockets across **C16, R12,** via switch **S16** and mains isolating condenser **C26.** In the gram position of the waveband control, **S4** and **S8** close to mute radio, while **S16** closes to connect the pick-up, which may consequently be left permanently connected.

Second diode of **V3,** fed from **V2** anode via **C15,** provides DC potentials which are developed across load resistances **R15, R16** and fed back through decoupling circuits as GB to FC and IF valves, giving automatic volume control. Delay voltage, together with GB for triode section, is obtained automatically from drop along resistance **R13** in cathode lead to chassis.

Resistance-capacity coupling by **R14, C19** and **R17** between **V3** triode and pentode output valve **(V4, Mullard CL33).** Provision for connection of high impedance external speaker in anode circuit, or low impedance one on **T1** secondary.

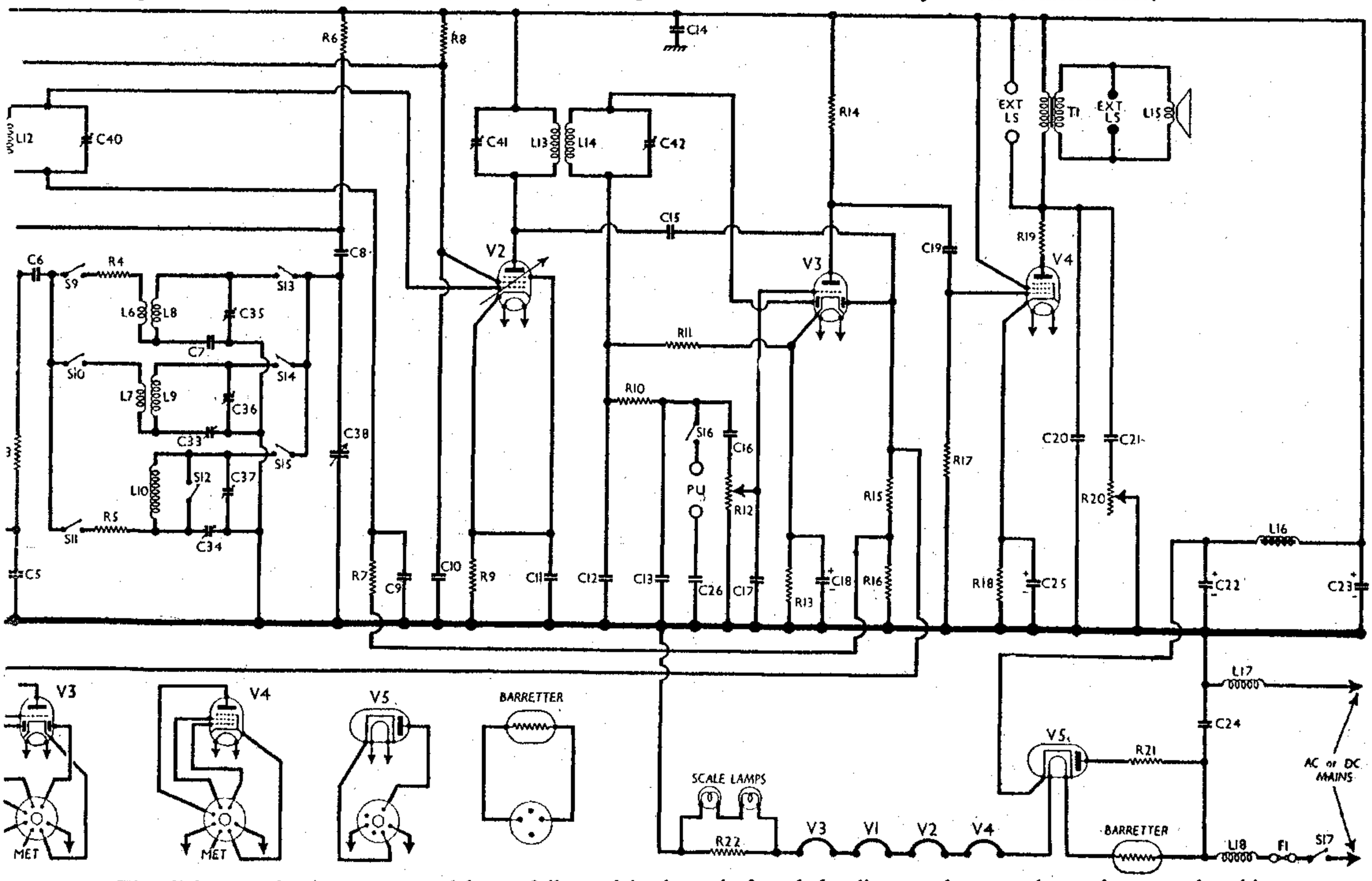


All models have the above appearance.

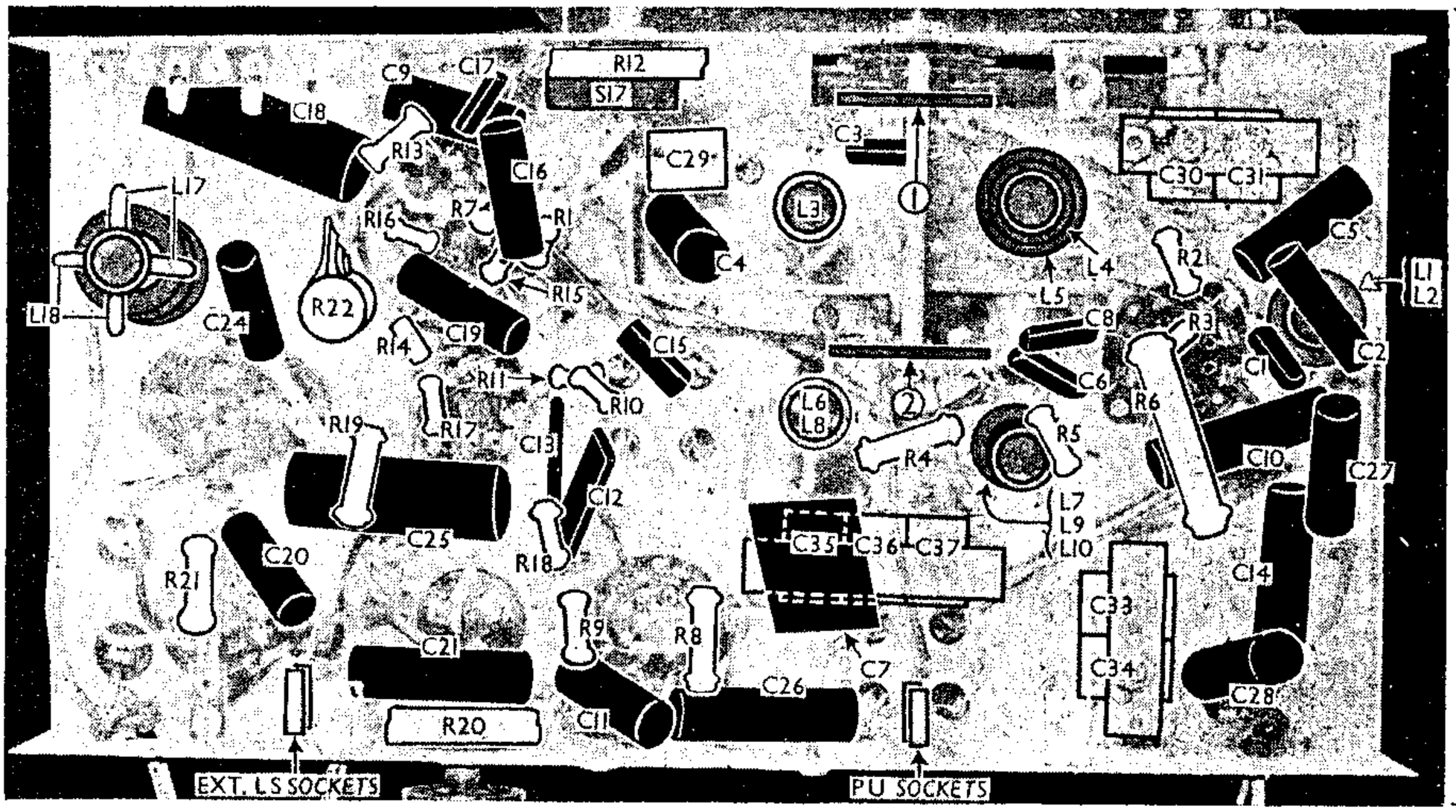
Fixed tone correction by **C20** in anode circuit, and variable tone control by **C21** and **R20,** also in anode circuit. All these devices are connected at the remote end of the anode stopper resistance **R19.**

When the receiver is operating from AC mains, HT current is supplied by IHC half-wave rectifying valve **(V5, Mullard CY31)** which, with DC mains, behaves as a low resistance. Smoothing by iron-cored choke **L16** and electrolytic condensers **C22** and **C23.**

Valve heaters, together with current regulating ballast resistance **(Barretter, Atlas 150A/4)** and scale lamps with their shunt resistance **R22,** are connected in series across mains input. Filter comprising air-cored chokes **L17, L18** and by-pass condenser **C24** suppresses mains-borne interference.



superhet. The differences in the export models are fully explained overleaf, and the diagram there can be made to overlap this one.



Under chassis view. The two switch units are indicated here by arrows, and numbered to agree with the diagrams in col. 3 below, where they are shown in detail. The two units are separated by a vertical metal screen, with the aerial and oscillator coils on either side. The connecting tags of the mains RF filter chokes are indicated.

DISMANTLING THE SET

Removing Chassis.—Remove the three control knobs (pull-off) from the front of the cabinet;

remove the four round-head screws (with square claw washers) holding the chassis to the bottom of the cabinet.

The chassis may now be withdrawn to the extent of the speaker leads, which is sufficient for normal purposes.

To free chassis entirely, unsolder from the connecting panel on the speaker transformer the two leads connecting is to chassis.

When replacing, connect the two speaker leads to the two tags at the ends of the connecting panel; the two centre tags take the leads from the speech coil.

Removing Speaker.—Unsolder the two leads as described above;

remove the four brass hexagon nuts holding the speaker to the sub-baffle.

When replacing, the transformer should be at the top left-hand corner of the assembly, when viewed from the rear.

VALVE ANALYSIS

Valve	Anode Voltage (V)	Anode Current (mA)	Screen Voltage (V)	Screen Current (mA)
V1 CCH35	225	0·8	65	1·5
	Oscillator			
	105	3·9		
V2 EF39	225	3·8	65	1·1
V3 EBC33	90	2·2	—	—
V4 CL33	200	53·0	225	10·0
V5 CY31	250†	—	—	—

† Cathode to chassis, DC.

Valve voltages and currents given in the table above are those quoted in the makers' manual; and they represent conditions to be expected in an average receiver when the smoothed HT line voltage is 225 V. The unsmoothed voltage should be 250 V, and the total DC current 76 mA.

When making these measurements, the receiver was tuned to the highest wavelength on the MW band and there was no signal input.

Voltages were measured with a 500 ohms-per-volt Avometer, chassis being the negative connection.

GENERAL NOTES

Switches.—S1-S15 are the waveband switches, and **S16** the pick-up switch, ganged in two rotary units beneath the chassis. They are indicated in our under-chassis view, and shown in detail in the diagrams (col. 3) where they are viewed in the direction of the arrows in the under-chassis view.

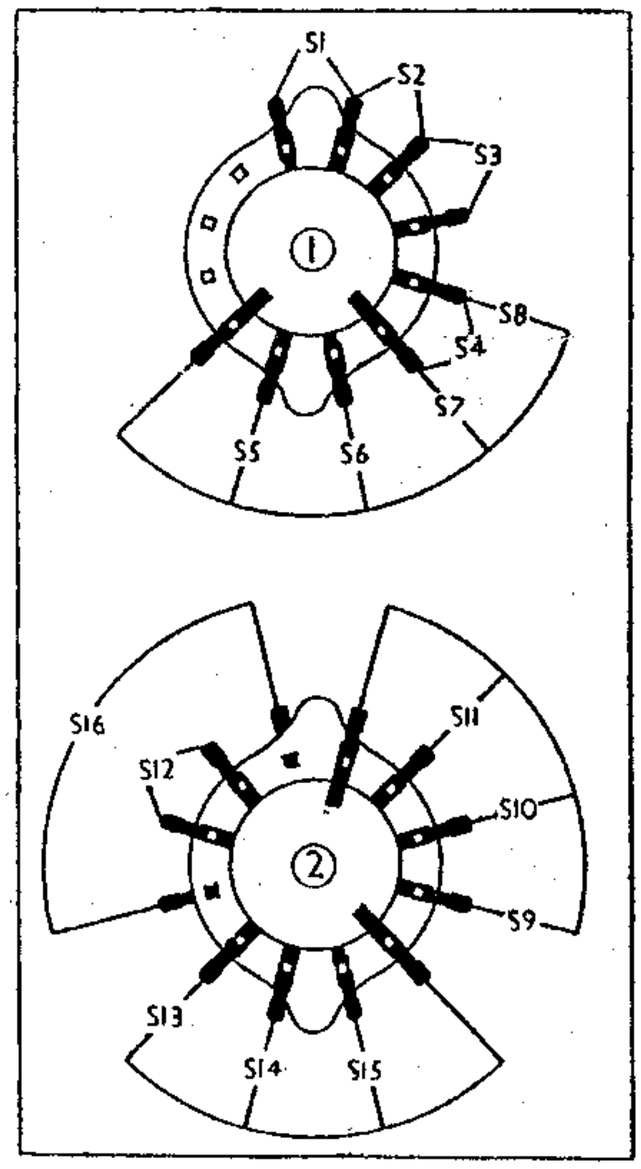
The table (col. 3) gives the switch positions for the four control settings, starting from the fully anti-clockwise position of the control. **A** dash indicates open, and **C**, closed.

S17 is the QMB mains switch, ganged with the volume control **R12.**

External Speaker.—Two of the sockets provided at the rear of the chassis are for a high impedance (4,000-5,000 O) external speaker. It should be noted that the sockets are in the HT positive circuit, and are "live" to the mains. Alternatively, a low impedance speaker (3-5 O) could be connected directly across the internal speaker speech coil, to the two tags near the centre of the connecting panel on the speaker input transformer. Subject to adequate insulation between the windings and core of the transformer, these tags are isolated from the mains.

Scale Lamps.—Those in our chassis were two American National Union MES types with spherical bulbs. They were marked 6-8 V. Suitable replacements would be the standard 6.3 V 0.3 A lamps, although the amount of illumination may then differ from the original. They are shunted by a 200 O resistance **R22,** and the heater current is 0.2 A.

Condensers C22, C23.—These are two TCC dry electrolytics in a single tubular metal container, mounted vertically in a clip on the chassis deck. They are each rated at 16 μF, 350 V working, 400 V surge. The three connecting tags, which are reached from beneath the chassis, are colour coded. The red spotted tags are the positive connections of the two condensers, and the plain tag is the common negative connection.



Diagrams of the switch units viewed from the rear of the underside of the chassis. The switch table is below.

Switch	SW	MW	LW	Gram.
S1	—	—	C	—
S2	—	C	—	—
S3	C	—	—	—
S4	—	C	—	C
S5	C	—	—	—
S6	—	C	—	—
S7	—	—	C	—
S8	—	—	—	C
S9	C	—	—	—
S10	—	C	—	—
S11	—	—	C	—
S12	—	C	—	—
S13	C	—	—	—
S14	—	C	—	—
S15	—	—	C	—
S16	—	—	—	C

CIRCUIT ALIGNMENT

IF Stages.—Switch set to SW, and turn gang and volume control to maximum. Remove the top cap connector of **V1** and connect a 500,000 O resistance between the connector and the top cap of the valve. Connect the signal generator, via a 0.0002 μF condenser, between the grid (top cap) of **V1** and the earth lead.

Feed in a 470 KC/S signal, and adjust **C42, C41, C40** and **C39** in turn for maximum output. Repeat these adjustments.

RF and Oscillator Stages.—With the gang at maximum, pointer should be horizontal. Connect signal generator, via a suitable dummy aerial, to aerial and earth leads.

SW.—Switch set to SW, tune to 15 m on scale, feed in a 15 m (20 MC/S) signal, and adjust **C35,** using the peak involving the lesser capacity, and then **C29,** in that order, for maximum output. There is no adjustable tracking on this band, but performance should be checked at 50 m (6 MC/S).

MW.—Switch set to MW, tune to 214 m on scale, feed in a 214 m (1,400 KC/S) signal, and adjust **C36,** then **C30,** for maximum output. Feed in a 500 m (600 KC/S) signal, tune it in, and adjust **C33** for maximum output while rocking the gang for optimum results. Repeat the 214 m adjustments.

LW.—Switch set to LW, tune to 1,250 m on scale, feed in a 1,250 m (240 KC/S) signal, and adjust **C37,** then **C31,** for maximum output. Feed in a 2,000 m (150 KC/S) signal, tune it in, and adjust **C34** for maximum output while rocking the gang for optimum results. Repeat the 1,250 m adjustments.

EXPORT MODEL MODIFICATIONS

The export version of the 101 series employs what is virtually the standard English chassis with modifications to suit overseas requirements. There are an AC and an AC/DC model, and they are distinguished by the suffix letter "X" in their type numbers : 101X is the export version of the 101 AC ("Trader" *Service Sheet* 550) ; and 101UX is that of the 101U, which is covered by this *Service Sheet.* Special AC and AC/DC models have an additional mains voltage tapping for low voltage mains. This is available in "X" models only.

The differences between the English and export models are exactly the same in the AC and AC/DC models, and the following remarks apply equally to the 101X and 101UX, with the single exception that in the original 101 AC we found that **V4** cathode by-pass was omitted, whereas it is present in the 101X.

Three wavebands are provided in the export models, but they comprise two SW bands (SW1 and SW2) and one MW band (referred to in makers' manual as "BB"). There is no LW band. The aerial and oscillator circuits are, therefore, very different from those of the English models, and we include a separate diagram showing the modified part of the circuit in cols. 5 and 6.

For convenient reference, the sheet may be folded to permit the modified circuit to overlap the original drawing overleaf and thus show the complete diagram of the 101UX.

The SW1 band in the 101UX is the same as the SW band in the 101U; the SW2 band takes up the position occupied in the 101U by the MW band; and the MW band, with a modified aerial circuit, moves down in the diagram to the position occupied in the 101U by the LW band. The SW2 wave range is 50-166.5 m.

In the modified diagram all the numbered components bear the same number as they do in the 101U diagram overleaf. Additional components (mostly those introduced with the SW2 band) are not numbered, while some components (those associated with the discarded LW band and the special aerial coupling circuits) are omitted from the modified diagram.

It will be seen that the original SW band (now SW1) is unaffected in the modified version. The aerial coupling coils for SW2 and MW bands are connected in series across the aerial circuit, while the original LW short-circuiting switches **S4** and **S12** are transferred to the MW band. Another switch, which is connected across the new MW aerial coupling coil, closes on SW2, so that while this band is in operation all the MW aerial and oscillator coils except **L7** are short-circuited.

The switches, with the exception of the one just mentioned, all bear the same numbers as they do in the 101U diagram overleaf. It is apparent from the makers' diagram of the "X" models that the order of switching, from the fully anti-clockwise position of the control, is : SW1, SW2, MW, gram; so that **S6, S10** and **S14** now close on SW2 instead of MW, and **S7, S11** and **S15** now close on MW instead of LW. This is, of course, consistent with our suggestion that the MW circuits have been moved down in the diagram to the original LW position.

The positions of the pre-set condensers are in the same band sequence as in the English model; that is to say, SW1 adjustments are in the positions occupied by the SW adjustments in the 101U, SW2 adjustments take the positions *vacated* by the MW band, and the MW band adjustments take up positions occupied in the 101U by LW adjustments.

CIRCUIT ALIGNMENT (Export Models)

The order of alignment in the makers' instruction is IF stages, SW1, SW2 and MW. Except for the SW2 band, the proceedure for the 101U may be followed. The following is the procedure for SW2, assuming the IF and SW1 to have been completed : :

Switch set to SW2, tune to 4.5 MC/S on scale, feed in a 4.5 MC/S (66.7 m) signal, and adjust the oscillator and aerial SW2 trimmers for maximum output. Feed in a 1.8 MC/S (166.7 m) signal, tune it in, and adjust the SW2 tracker for maximum output while rocking the gang for optimum results. Check calibration at 4.5 MC/S.

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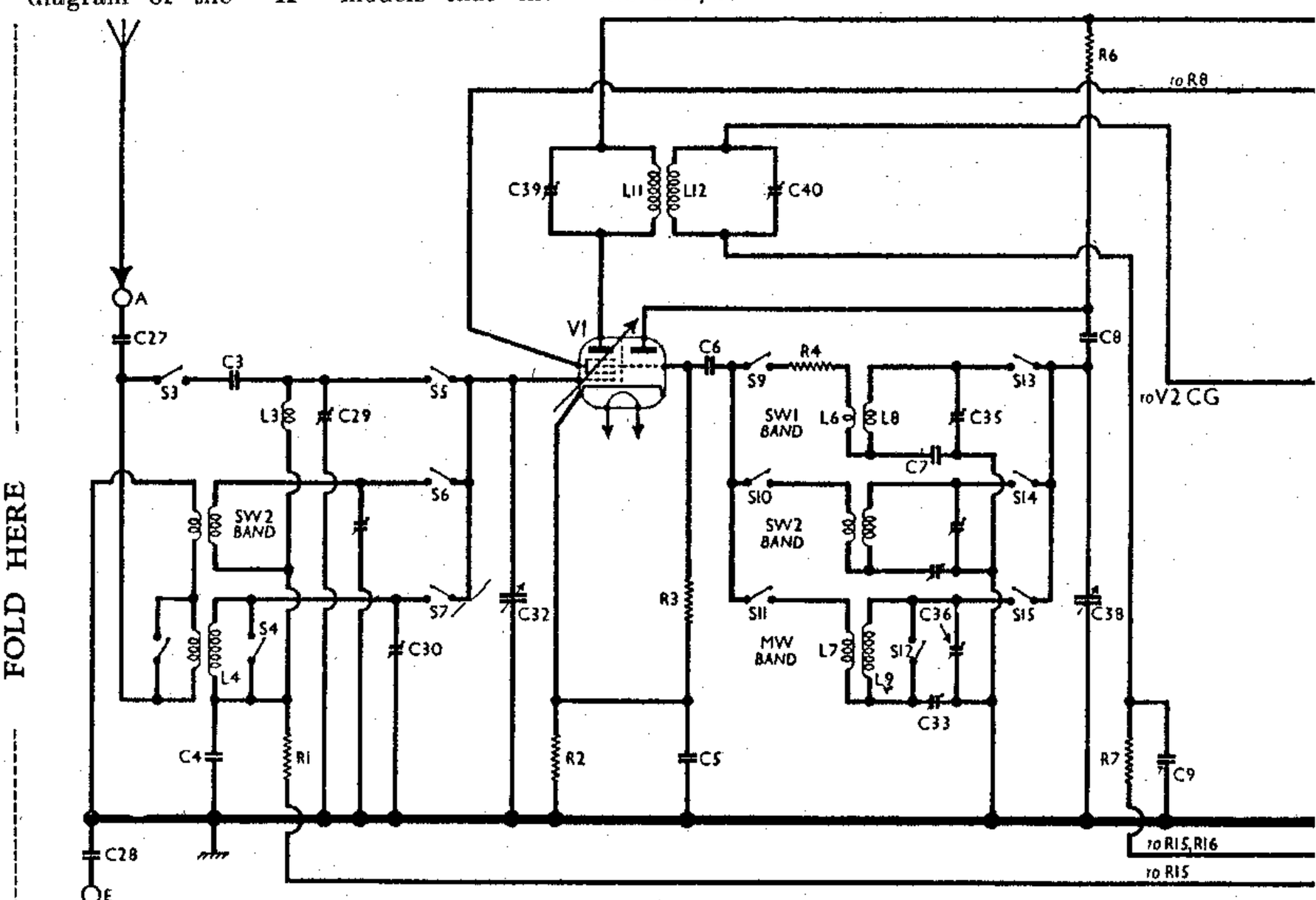

Affected section of the circuit diagram showing modifications in the export models. Except for the inclusion of the mains isolating condensers **C27, C28,** this diagram applies equally to the 101X (AC) and 101UX (AC/DC) models. Components retained from the original English model bear the same numbers as in the circuit diagram overleaf; added components are not given numbers. If this page is folded as indicated, this diagram will overlap that overleaf, giving the complete 101UX circuit.

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